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Research & Reality of Side Impact Collision in India: Review

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Abstract -*Motor vehicle crashes will continue to occur in spite of all human efforts to prevent them. India has a high number of deaths due to avenue injuries & Indian automotive safety standards have been criticized as being insufficient and ineffective. India has the world's sixth-largest car market but is still the only country among the global top ten car markets without proper new car safety regulation or testing programs. Among front, side, and rear-impact collisions, side impacts are the most likely to be fatal. They're much more likely to be fatal for the basic reason that there's a lot less material between you and the 1500 KG of another vehicle careening toward you. Up till now, many kinds of research are carried out to investigate the detrimental effect of side impact & ways to reduce it. Most of the research was carried out on side impact beam & found as an effective solution in a side impact. In overseas countries, the utmost significance is given to automotive safety with the growing of many organizations together with Insurance Institute For Highway Safety (IIHS), European National Car Assessment Program(Euro NCAP) & plenty extra. Recent Crash Test performed by Euro NCAP for Indian motors raised a big question about the extent of safety. As Better late than never, Indian government soon start BNVSAP (Bharat New car safety assessment program) to check automobiles for safety angle. This paper will attempt to put a mild on safety requirements, regulations, research on an aspect of side collisions.*

Key Words: IIHS, Euro NCAP, BNVSAP, SI beam, BIW, RSM model, UTS results, FEA, MSC PATRAN, NASTRAN, OPS, and LWA.

1. INTRODUCTION

A side effect collision takes place when a vehicle is hit on its side at an approximately ninety-degree angle. Another call for those injuries is "T-bone" injuries. Among the potential reasons for a side impact accident are distracted driving, drunk driving, and failure to yield. For example, a driver who fails to follow the road rules related to the right of way at a four-way stop sign may enter the intersection at almost the same time as the car to its right and crash into that car.

Driver and passengers involved in side impact collisions mostly get severely injured as compared to another type of collisions. The reason behind this is the availability of very low survival space. Due to the fewer space available occupant affected by severe injuries such as head injuries, ear injuries, neck injuries, back injuries, rib injuries, shoulder and arm injuries, or hip and leg injuries. This space varies from 5 cm to maximum of 25 cm, which decides how safe the car is. Every cm between you and a life-ending amount of energy is a life-preserving cm of survival space. Mercedes-Benz E-Class sedan is the safest mainstream car when it comes to side impact crash survival with 24 cm of survival space.

Designing a car with effort focuses on increasing crash survival space is necessary. With such Moto, many researchers have been continuously conducting experiment since the era of the nineties These researchers have proved that major role of absorbing impact energy & reducing the intrusion of impacting body is played by Side impact beam. Hence, the location and appropriate design of the SI beam is very important to pass stringent regulations like Insurance Institute of Highway Safety (IIHS) Side Pole.

1.1 Life-threatening injuries in side impact

Head, thorax, and pelvis are the main body areas injured and the interior door surface is the most frequent impacting part. The thoracic injury is the highest making injury in non-roll-over, non-ejection side impacts. After the study, it is found that in car-to-car crashes, side impacts gave rise to more severe injuries than frontal impacts. For disabling injuries to be reduced the neck and legs need better protection; as regards life-threatening injuries, chest injuries become up to four times more frequent with advancing age. Injuries were twice as common on the struck as on the opposite side. [1]

When fatalities alone are considered, multiple body regions are frequently injured as head (64%), chest (85%) and abdomen (26%) predominated injuries in the struck side occupant. On the opposite side, the head was most frequently injured (85%) followed by the chest (73%) and abdomen (49%). In both positions, in this series, the occupants had more neck injuries than in the non-fatal series. Dalmotas found that, with regard to occupants restrained by seat belts, there was more injury to the shoulder, chest, pelvis, and legs among impact-side occupants, whereas there was more injury to the neck, abdomen and arms in far-side occupants. [1]

2. LITERATURE REVIEW

Dhaneesh K P et al. [2], demonstrated the different advanced concept to enhance the performance of side impact beam. To minimize the resulting intrusion in side impact it is very essential to increase the strength of material. By keeping this view author selected DOCOL1200 material, which is kind of high strength steel. The acceptable value for Maximum displacement according to FMVSS 214 regulation is 154 mm & with the current design, deformation noticed to be 180mm. By performing a number of iterations author has optimized the design and finally updated the material. The maximum displacement in final case is 140 mm which is less than the upper limit value of FMVSS 214 new regulation.

T. L. Teng et al.[3] focused their study on a Ford Taurus model. The full-vehicle FE model was developed & analyzed in a dynamic side impact test. The author mentioned two important injuries thorax injury & pelvic injury as well as the causes, detrimental effect on occupants seating in the car. The impacting force to the dummy pelvic area by the intruding side structure is potentially the most injury-causing factor. Likewise, the intrusion at the mid-door and window sill levels would potentially influence the thorax area of the dummy. Placement, shape, and material are factors that dominate the effectiveness of protection afforded by the side-door beam. To minimize damage to the individual's involved, optimal design of side-door beam will be the future driving force in the passive safety of research.

Avinash P. Pawar et al. [4], replaced currently used S-shaped side impact beam in Ford Taurus having material high strength steel (AISI 4340) with a better design.For the new design, high strength steel (AISI 4340) is considered & put effort to reduce the total weight of the car without sacrificing the safety of the passenger. For static analysis instead of using complex door assembly preference given for simplified model for same. Impact force of 501945.5 N applied to study intrusion behavior for regular S-shaped beam, circular beam, and rectangular beam. As per the requirement, initial mean crush resistance up to first 150 mm should be greater than 10 KN and observed crush resistance in S-shaped steel beam is 15.7 KN were as in thermoplastic glass epoxy fiber composite is 5KN as it is below the criteria due to improper location of the beam and can be increased with improved beam placement. For displacement from 150 mm – 300 mm, the Intermediate mean crush resistance should be greater than 15.6 KN and for 300 mm – 450 mm displacement, peak crush resistance should be greater than 31.2 KN. For both intrusion beams, observed crush resistance is well above the required criteria. However, crush resistance offered by the composite beam is way more than that of the steel beam. As composite beam offers 125 kN crush resistance as compared with 77.1 kN offered by steel. It can be seen that composite beam absorbs more energy than that of steel. Thus intrusion of hitting a body in the passenger compartment can be drastically reduced by using composite beams in the car side door.

Dinesh Ugale et al. [5], analyzed an RADIOSS Ford Taurus public domain free model to access the effectiveness of DSI beam at 50kph side impact and 30kph pole impact test modes as per IIHS regulation. The author did four-run of simulation for side impact analysis. By observing the results of run1, 2, 3, 4 for 1.5mm and 3.5 mm thick DSI beam, for both side impact and side pole impact, it is concluded that the orientation of Dynamic Side Intrusion beam for all design configurations doesn't have a prominent effect on the velocities of side structure because higher forces are acting on the side structure from the impacting barrier and pole will affect the effectiveness of DSI beam. It is observed that front door absorbs more energy. A similar trend is observed inside pole impact as well.

Vijayan.P et al. [6], tested three different material simultaneously using finite element analysis to investigate their effect on structural modification and impact absorption. The maximum allowed crush resistance for FMVSS standard is 152 mm at initial load condition of average 1020kg load. The car door panel of the outer and inner panel is modeled separately & considered the thickness of 1.2mm for an inner and outer panel of the entire concept. BY employing magnesium alloy in mono & hybrid construction light weight and crash resistive structure developed

Goichi Ben et al. [7], have developed CFRP and Al hybrid beams as impact energy absorption members for side collision. In their research, Three kinds of unidirectional CFRP laminate (T700, M40, and T800) and three types of adhesive (Urethane, High-strength, and High elongation) were used, respectively. Eighteen numbers of specimens are experimentally tested. Careful observation of impact behavior of hybrid CFRP and Al beam shows the breakage of adhesive and not the breakage of CFRP laminate. If we neglect the value of initial peak load we get to see a good agreement of the load –displacement relation with an minimal error of absorbed impact energy was 7% between both results.

Raja Sharmi Raja Husin et al. [8], pointed their research to optimize the crashworthiness of side door structure by applying structural optimization techniques rather than numerically analyzing and experimentally validating currently used side structure and door trim. In this research, the performance of a side door beam is predicted using only the door beam and not the BIW system. In considering the effect of the BIW system, an equivalent modeling is utilized. Author implement response surface method (RSM) to determine the thickness and the cross sectional

shape of a side door beam. This ensures optimization of energy absorbed by side door beam with respect to the mass density. The design variables considered in research were the thickness and the shape cross section. After summarizing the FEA results on 25 thin-walled beam models, a final RSM model developed. In RSM model linear, quadratic and cubic polynomials are used in order to validate the selection of design points and the orders

Rajesh Male et al. [9], done parametric research for side impact. They considered the effect of material, thickness, an outer diameter on a characteristic of side impact beam. In the analysis, the tube is considered as a deformable body while the loading device and supports are considered as rigid bodies for reducing the computation time. The load carrying capacity, energy absorption characteristics of a SIB tube can be tested by static bending test or three-point bending test method (Federal Motor Vehicles Safety Standard No. 214).SIB is tested at a velocity of 2mm/s. We get an idea about the effect of each parameter on the load carrying capacity and energy absorption characteristics of the tube. The increase in UTS results in more force, the energy required to bend and also results in an increase in buckling of the tube. The buckling of the tube reduces with increase in the thickness of the tube and increases with increase in OD of the tube.

Ramesh Koora et al.[10], carried out their research for crush beam of Nissan titan chassis. Crush beams of the U-shaped cross section having length 450mm considered for both inner and outer side. Crush beams are made of mild steel. To evaluate transmission of forces author considered various section planes in chassis.The author proposes four designs and investigated individually energy absorbed in each case. Baseline model, increased cross section, baseline with reinforcement & tailored rolled blanks were the four proposed design among which tailor rolled blank showed maximum energy absorption of 12196 J.

MohdFadzliAbdollah et al.[11], shows efficient use of FEA (finite Element Analysis) in structural modification & evaluating impact energy absorption of the different material. As part of practical experimentation, the author conducted charpy impact test. Since aluminum possesses the higher strength to weight ratio than that of conventional steel it is selected as a potential material for side-door impact beams. Proton Wira which is Malaysian manufactured car is considered for adopting side door impact beam dimensions. Impact beam with outside & inside diameter of 40.2 mm & 34.2mm respectively having length 830 mm is seen to be installed in the side door of the car. Universal impact tester utilized to capture impact energy absorption using charpy impact test.

HarijonoDjojodihardjo et al.[12], performed two types of analysis. The first is a static analysis of equivalent impact load calculated using equivalent energy principle, and the second is a dynamic analysis to calculate the dynamic characteristics of the impact beam for comparative study purposes. The analytical approach is considered as a baseline to utilize finite element analysis using both in-house MATLAB program as well as the commercially available MSC PATRAN and NASTRAN.The author suggested numerical methods, such as FEM or analytically modified transfer matrix method for problems involving complicated geometries, loadings, and material properties. By using the direct equilibrium approach, the nodal forces in the Finite Element Approach can be related to the nodal displacement with the use of shear force and bending moment relationships. Appropriate boundary conditions should be applied so that the structure remains in place instead of moving as a rigid body. The author used CATIA for developing the geometrical model of the impact beam. The existing design is made of ISO 31CrNiMo8 steel while glass-fiber reinforced polymer (GFRP) E-glass or Epoxy (Scotchply 1002) is considered for new design. Although the carbon-fiber-reinforced polymer (CFRP) has the highest specific modulus and specific strength among the fiber reinforced polymer, the E-glass/Epoxy still being chosen due to its impact energy absorption.

In this thesis K.Veeraswamy et al.[13] employed carbon,Epoxy AS4/3051-6as material for side impact beam. The Finite element models of a door and consequently the moving solid block are utilized for the analysis during this thesis. Efficacy of top beams is compared by checking the beams according to the FMVSS 214 aspect impact standard. C-section impact beam of length 947 mm long 105 mm wide with a standardized thickness of 2.3 mm is used. The encumbrance of the beam is 2.44 Kg.The impactor is taken into account as a rigid body with mass 20kg and diameter of 200 mm cylinder. The fundamental question of this examination work is to supplant the present side effect beam with the better outline and utilizing a composite material rather than steel to diminish the aggregate weight of the car without yielding the security of the peregrinator. Along these lines in this study as per the fundamental standards of crashworthiness which express that the interruption of the striking conveyance ought to be least and the vitality retaining capacity of the distorting structure ought to be high, the utilization of the composite side effect pillars on the car entryway has been proposed and its viability in diminishing interruption has been assessed.

A.G. Olabi et al.[14]awarded an outline of energy absorbers within the type of tubes wherein the foam used is predominantly moderate metal or aluminum. Also reviewed common modes of deformation similar to lateral and axial compression, indentation and inversion. Theoretical, numerical and experimental methods which help to have an understanding of the behavior of such devices below quite a lot of loading conditions are outlined. The target of this paper is to provide a perception within the field of kinetic energy absorbers which might be used to

mitigate impact collisions. More than a few work developed via researchers and engineers over the final half century pertaining to metal energy absorbers are highlighted. Such absorbers can appear in the type of round tubes, rectangular tubes, frusta, struts, honeycombs and sandwich plates. This article will highlight the research and findings frequently involving tubes and frusta's as impact energy absorbers. It used to be outlined that energy absorption can fall into three categories; (1) fabric deformation, (2) friction and (three) extrusion, where the former is the topic of this paper. The efficiency of energy absorbers is dependent upon their certain utility and suitability. Various parameters akin to distinctive energy, crush effectively, energy affectivity is usually measured to describe the behavior of those contraptions.

Strength to weight ratio ought to be high while choosing material for automobile systems. By this thumb rule, several researchers conducted an associate experiment with a range of materials. Ultimately best results are found with Al alloys, AHSS steel, HSLA (high strength low alloy steel). This material exhibits terribly high strength as compared to standard steel. However, these are very pricey materials A shot was necessary to seek out some cheap solutions which can serve the aim of absorbing impact energy Therefore some researchers have conducted their experiment on how we can use waste recycle material for absorption of impact energy. A little try is made to throw light on such out of box analysis.

Ahmed Tareq Noamana et al.[15], scrutinized the effect of aggregate between crumb rubber and steel fiber on low-velocity impact energy of concrete beams. Crumb rubber ranging in size from 1–2 millimeters was recycled from waste tires. This rubber was then incorporated into traditional concrete (NC) and steel fiber concrete (SFC) mixes by partly exchange fine aggregate at two completely different ratios (17.5% and 20%) by volume. A low-speed drop hammer with a mass of 5.1 kg was dropped over and again from a tallness of 0.17 m until the underlying crack was produced. The procedure proceeded until bar disappointment. Impact energy enhanced extensively at both introductory split and extreme disappointment through the blend of steel fiber and crumb rubber.

There's want for research on stuffed steel tube columns making use of this new release of excessive performance concretes, because many of the available literature is founded on NC or SCC. For this reason, this study is warranted by Katie Chu[11]who studied the axial load behavior of CFST columns utilizing ECC, LWC, and CRC. In the course of checking out, failure modes and total behavior of CFST columns had been monitored. Rubber concrete showed greater toughness compared with NC. Round, square, rectangular concrete crammed steel tube (CFST) columns with quite a lot of in-fill materials and slenderness have examined in this study.

Ingeniousness & perception can flip waste product into just right one. We get its proof when we learn Mohd Zamin Jumaat et al.[16], Research paper "Oil palm shell light-weight concrete as a ductile material". Oil palm shell (OPS) is a lightweight aggregate (LWA) from the agricultural sector and is one of the forms of waste due to the palm oil industry. Most prior stories have shown that OPS can be utilized as an LWA for engendering structural LWC with compressive energy in the variety of 17–35 MPa. Consequently inundated tremendous oil palm shell (OPS) was utilized as a rough coalescence in 4 one-of-a-kind concrete combos. On this paper, the stress–stress comportment and E price of grade 30, 40 and 50 beaten OPS concrete had been investigated and when put next with those of prevalent weight granite concrete and incremented clay LWC.Normal Portland cement (OPC) with a concrete gravity of 3.14 g/cm3 and fineness of 3510 cm2/g used to be utilized. The 7 and 28-day compressive force of the cement was 34.2 and forty 5.9 MPa, respectively. The stress–pressure habits and modulus of elasticity of OPS concrete were investigated and in comparison with granite mundane weight concrete (NWC) and elevated clay lightweight concrete (LWC) The highest E worth of about 18.Four GPa used to be done on this learn, which is greatly more immensely colossal than prior reviews.

A.P.C. Duarte et al. [17], have done an experimental investigation on the force and ductility of brief metal tubes stuffed with rubberized concrete (RuC), sourced from recycled scrap tires, is offered in this paper. The impact of quite a lot of parameters, such as form (square, rectangular, circular), metal grade, and concrete mix (ordinary concrete versus RuC), on the quick column force and ductility is analyzed and discussed. From a realistic viewpoint, this might be an essential benefit for buildings in seismic areas where energy dissipation is required. In CFST columns, the steel tube acts as formwork and supplies confinement to the concrete core, making improvements to its force and ductility, whereas the concrete core reduces the metal tube sensitivity to local buckling.

With a purpose to gain knowledge of the behavior of quick CFST columns, three specific concrete mixes had been considered: (in) general concrete (NC) and two rubberized concrete (RuC) mixes, bought by means of replacing (ii) 5% (RuC5) and (iii) 15% (RuC15) of whole ordinary aggregates volume of the NC composition with tyre rubber particles, in the coarse fraction of aggregates.

While practical expeimenttion author finds that, the splitting tensile force applied to RuC15 specimens no loud sound was heard and the halves of the cylindrical specimens remained linked by the use of the rubber particles, qualitatively indicating an extra ductile fall down of RuC15 than that of NC. This crumple mode used have numerically validated by the author through the numerical simulation of a RuC15 cylinder subjected to splitting tensile test.

3. CRASH TEST

A crash test for vehicle safety is a kind of destructive testing undertaken to ensure that standards for safe design with regards to crash compatibility and crashworthiness are followed for different transportation modes. There are multiple kinds of crash tests for vehicle safety undertaken to provide the necessary information and guidance to vehicle owners.
Crash test can be classified as

1. Front Impact
2. Side Impact
3. An offset Test
4. Rollover Test

3.1 Side Impact Test Configuration

Side impact crash tests consist of a stationary test vehicle struck on the driver side by a crash cart fitted with an IIHS deformable barrier element. The 1,500 kg moving deformable barrier (MDB) has an impact velocity of 50 km/h (31.1 mi/h) and strikes the vehicle on the driver side at a 90-degree angle.[18]

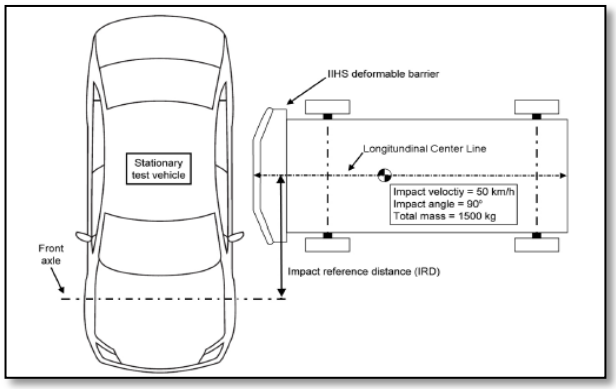

Fig -1: MDB Alignment with test vehicle

3.2 MDB Properties

The MDB consists of an IIHS deformable aluminum barrier and the cart to which it is attached. The MDB test weight is 1,500 ± 5 kg with the deformable element, test instrumentation, camera, and camera mount. The MDB center of gravity in the fully equipped test condition is 990 ± 25 mm rearward of the front axle, 0 ± 25 mm from the lateral centerline, and 566 ± 25 mm from the ground. The MDB roll (IX), pitch (IY), and yaw (IZ) moments of inertia are 542 kg-m2, 2,471 kg-m2, and 2,757 kg-m2, respectively. The deformable element has a width of 1,676 mm, a height of 759 mm, and a ground clearance of 379 mm when mounted on the test cart.[18]

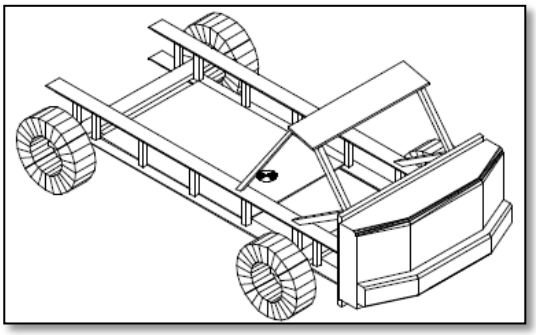

Fig -2: Test Cart with Moving Deformable Barrier

3.2 Antiroll Device

To prevent a possible rollover subsequent to the side impact, vehicles with high centers of gravity (those classified by IIHS as SUVs, pickups, or passenger vans) will be tested with an antiroll device attached to the struck side of the vehicle. The antiroll device is made primarily of 4130 Chromoly structural tubing and weighs 42.5 kg. [18]

Fig -3: Antiroll device for test of SUV & pickup

4. SIDE IMPACT BEAM

Side impact door beams are a safety feature of modern cars designed to protect the driver and passengers. The side impact protection beam has to absorb the energy in the door area and maintain high survivability for the vehicle's occupants. Door deformation has to be limited in order to provide a side airbag with enough space between the vehicle's door and the seat. The most common solutions for side impact beams are extruded aluminum sections, round steel tubes, and press-hardened or ultra-high strength steel sections.

With the increasing size and height of vehicles on the road, including SUVs and vans, side impact beams have become a more popular safety feature for cars of all sizes. The beams provide extra protection during instances when smaller cars may be struck by a larger SUV

Fig -4: Hyundai Azera showing the side impact beams and the side impact airbags deployed.

5. HOW MUCH SAFE ARE INDIAN CARS?

Global NCAP has recently conducted a crash test on most famous Indians cars as the Renault Kwid, Maruti suzuki celerio, Maruti suzuki eeco, Mahindra Scorpio and Hyundai eon. Crash test results from Global NCAP Delhi continue to disappoint with all five models rated as zero stars. The Renault Kwid, Maruti Suzuki Celerio, Maruti Suzuki Eeco, Mahindra Scorpio and Hyundai Eon all showed low levels of adult occupant protection.

Even though the Indian car business has witnessed exceptional growth over the last three decades however such results are deplorable for this exceptional growth of Bharat. Without disappointments, it's time to place our effort for analysis & develop our safety commonplace so as to boost extent of safety in Indian cars.

6. INDIAN GOVERNMENT STAND ON AUTOMOTIVE SAFETY

The Republic of Indian government has accomplished that redundant safety standards are followed in India which has sparked the requirement to use higher laws on automobile safety in our country. So the government is taking multiple steps to produce safety to each national of the Republic of India in road accidents. The government is taking initiative for making contributing surroundings for investment, development of recent and economical infrastructure, gap up to new sectors for foreign investments and shaping a partnership between government and business through a positive mindset.

The ARAI is functioning closely with the government for setting up the new facility and is anticipated to embrace additional rigorous automotive safety rules that would be placed in place by 2019. The new standards are going to be necessary for all vehicles homologated India – regionally factory-made and foreign alike. The ARAI is also within the method of fitting automatic scrutiny and certification centers, wherever used or recent vehicles can get a fitness check to verify whether or not or not they fits the security, emission and traffic rules. This can be a step towards ensuring that rules are enforced essentially.

The government has also introduced Safety Rating Scheme (Bharat New Car Safety Assessment Program- BNVSAP) on similar lines of NCAP.Government plans & implemented date as quoted in question & answer session in Indian parliament Is attached here [19]

Date of Implementation	Applicability	Standard and description	UN Equivalent Standards	Pertaining to
1st Oct 2018	New car models – GVW < 2500 kg	AIS 100 – Protection of pedestrians and other vulnerable road users in the event of a collision with a car	GTR 9	Pedestrian body forms being impacted on the hood of the vehicle
1st Oct 2019	All car models, and LMV of GVW < 1500 kg	AIS 096 – Protection of driver with regards to steering column intrusion (speed of impact ~ 50 kmph)	UN ECE R12	Full Frontal Crash test
	All car models – GVW < 2500 kg	AIS 098 – Protection of the drivers and passengers in the event of an offset frontal collision (Speed of impact – 56 kmph)	UN ECE R98	40% overlap offset frontal crash test
	All Car models and LCV models category vehicles (with respect to height of vehicles)	AIS 099 –Protection of the Occupants in the event of a Lateral Collision (Speed of impact – 50 kmph)	UN ECE R99	Test of Moving deformable barrier crash perpendicular into stationary vehicle
1st Oct 2020	All car models – GVW < 2500 kg	AIS 100 – Protection of pedestrians and other vulnerable road users in the event of a collision with a car	GTR 9	Pedestrian body forms being impacted on the hood of the vehicle

Fig -5: Government of India's Plans for crash test

CONCLUSIONS

The Economy of India is eleventh largest economy in the world by nominal GDP and therefore the fourth largest by purchasing power parity. Besides government is also taking several useful decisions like demonetization or introduction of recent scheme like 'Make in India'. Recent record of India launching 104 satellites together with ninety that belonged to the United States is obvious proof of India's development.

Disappointment from recent crash test persuade be contradictory for the wonderful achievement of India .India is the sixth largest car maker within the world. India is the second largest inhabited country and its population admire17.86% of the entire world population .Thus India is a country who is very inhabited in terms of both Human & cars.In such scenario, it's terribly troublesome to forestall road accidents. It will be wise to work on safety campaign.

While shopping for automotive in India, safety options are treated as price supplementary package and not as necess-ary life saving kit. Indian mindset is extremely careless once it involves shopping for such safety options. Going for a basic model that isn't in any respect loaded with this safety options might save thousands of rupees however its price is negligible if compared along with your precious life. This straightforward issue still Indians might don't adopt and obtain a lower version of automotive. On alternative facet Government has conjointly not made it compulsory yet. That's why automotive manufacturers are taking it easily & producing an automotive that is extremely shiny in look & vogue, however, worst in safety.

Thus having ample of resources & launching totally different schemes won't change this image. We tend to first have to be compelled to change our mindset & strict necessary laws from the government is additionally expected After this ,safety are going to be want of market & therefore automotive manufacturers have to be compelled to offer it.

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BIOGRAPHIES

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